STRATEGY RESEARCH PROJECT

A TECHNOLOGY-BASED STRATEGY TO MANAGE PERIODONTAL PATIENTS AS PART OF A GLOBAL ARMY DENTAL CARE SYSTEM

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A Technology-Based Strategy to Manage Periodontal Patients as Part of a Global Army Dental Care System

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ABSTRACT

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Periodontal diseases are generally chronic in nature. The prevalence of severe disease in an adult population, age 35 or greater, approaches 15-20%. Extrapolated to an active duty army of 480,000, periodontal disease is predicted to affect approximately 24,000 soldiers. Comprehensive treatment usually involves multiple appointments. Successful outcomes require indefinite supportive care. The highly mobile nature of our Army population and possible requirements to treat members of the Total Force on a global basis make the treatment of periodontal diseases difficult. The problem is compounded by a high operations tempo, remote assignments and frequent deployments. During operational deployments and remote assignments, access to specialists is either extremely limited or not available. Given the prevalence for a population age 35 and above, the majority of soldiers requiring treatment will be senior NCOs and field grade officers. If they do not receive needed treatment, these individuals are more likely to require emergency treatment, which may include evacuation from a theater of operations. Currently no mechanism allows dental commands to track the worldwide movement of periodontal patients. Advances in computers, Internet connectivity, and telecommunications provide the technology necessary to document the stage of treatment for a given patient and provide that information to the appropriate dental command. With improved tracking we can improve the health and readiness of our soldiers, decreasing the likelihood of emergency treatment that interferes with training and deployments. Effective treatment reduces overall costs to the military, making funds available for other programs.

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Changes in the traditional business practice of delivering periodontal care on a global basis could improve the health and readiness of our soldiers, decrease the amount of treatment time that interferes with training and deployments, allow the apportionment of periodontal treatment teams based on documented needs, and reduce overall costs to the military. At present, there is no existing strategy for globally managing military periodontal patients. There is no mechanism that allows dental commands to track the worldwide movement of periodontal patients. Even at the local installation level, there is no systematic method for incorporating patients and treatment information into a database.

The lack of a global management strategy has significant implications for the military treatment population. To obtain successful outcomes, comprehensive periodontal treatment usually requires multiple appointments and indefinite supportive care. The highly mobile nature of the Army population makes the treatment of periodontal diseases difficult. The problem is compounded by a high operations tempo, remote assignments and frequent deployments. Currently, during operational deployments and remote assignments, access to specialists is either extremely limited or not available. Unfortunately, this could result in a lack of appropriate treatment, which has the potential to adversely affect outcomes.

In a pool of 480,000 active duty soldiers, up to 24,000 may be expected to have periodontal disease. It is difficult to determine the absolute cost of periodontal treatment in a military setting. Traditional civilian models that define the cost of periodontal treatment are not entirely accurate in a military setting. The cost of treatment must consider not only the cost of treatment relative to the clinic, but also must factor in the cost to the Army of time the soldier must spend away from duty. Even without exact cost data it is possible to compare expenditures in relative terms. The negative outcome from periodontal disease is tooth loss. The cost of tooth loss in untreated periodontal disease can be ten times that of a successfully treated case.[1] In almost all cases lost teeth require prosthetic replacement. Periodontal treatment is required prior to any prosthetic replacements for optimal function and esthetics. The significance is that untreated periodontal disease ultimately may result in a ten-fold increase in expenditures for treatment. Another disadvantage is the significant additional amount of time soldiers must spend away from duty.

Periodontal diseases are caused by bacterial infections that destroy the soft tissue and bony structures that support teeth. If not treated, gum diseases can result in tooth loss. Infections can affect overall health. Current research shows that periodontal disease is a possible risk factor for stroke, preterm low birth weight babies, and coronary heart disease. Because there are no symptoms in the beginning stages of the disease, patients do not seek treatment on their own. Without command emphasis to help soldiers get into the dental care system for treatment, they are at risk for not receiving care.

The need to improve and modernize the ability to deliver periodontal care, as an extremely important part of dental service support, is consistent with the following statement by General Shalikashvili, "We need to figure out across the board how to make our infrastructure -- the defense agencies, the depots, the labs, the hospital system, the training base -- those things that take up 60 percent of the armed forces -- we need to figure out how to make that part effective, efficient and modern."[2] This concept is further amplified by the Army Dental Care System's vision, "The Army's dental care system of choice, focused on readiness, health promotion, improved health outcomes, and exceeding our customers' expectations."[3]

Joint Vision 2010 points to a future where modular and specifically tailored combat service support packages will evolve in response to wide ranging contingency requirements.[4] Just on the horizon, Information Age Technologies will enable the new concept of focused logistics and our ability to project and sustain the force across the range of military operations. We will know the status and location of each person and unit in real time.[5] The ability to collect vast amounts of information and provide appropriate and timely analysis gives combat service support organizations ever-increasing responsibilities and capabilities. By fusing information, logistics, and transportation technologies, United States forces will be able to deliver the right support at the right place on the battlefield at the right time.[6] The tools and technology for achieving the vision articulated by the Army and the Army Dental Care System are now within reach.

To achieve the Army Dental Care system's vision relative to periodontal care, it is necessary to discuss strategy, the intellectual construct linking where you are today with where you want to be tomorrow in a substantive, concrete manner.[7] Meeting future challenges requires a strategy that addresses periodontal care and periodontal information on a global basis, in peacetime and throughout the spectrum of conflict. Advances in computers, software, Internet connectivity, and telecommunications provide the technology necessary to document the stage of treatment for a given patient and use the information to improve care worldwide. An effective strategy must leverage technology to provide treatment information that seamlessly follows the patient to the appropriate dental command and treating periodontist. The capability to track military periodontal patients as they move throughout the global strategic environment would give dental commands the ability to ensure appropriate specialists and ancillary personnel are positioned to deliver the right periodontal treatment at the right time and place, anywhere in the world.

No advantage is gained simply by using automation equipment.[8] The keys to this strategy are the ability to collect and disseminate the appropriate data, and then effectively analyze the flow of information. Successful implementation requires fully utilizing the unique expertise of the Army periodontist to synthesize information from a highly specialized knowledge base. This is extremely important because United States military periodontal treatment must always meet the standard of care defined by the English language periodontal literature, referenced in refereed scientific journals.

Additionally, those who employ any technology-based strategy must always be cognizant of the variety of possible asymmetric threats that could be directed at military and civilian information systems.

GLOBAL ENGAGEMENT STRATEGY

As globalization increases, the United States will face numerous challenges, opportunities, and threats, many of which will call for the use of the military.[9] The National Security Strategy of the United States describes an uncertain and dynamic environment, with vital interests in Europe, East Asia and South West Asia.[10] In addition to interests abroad, the possibility of terrorism, international crime, drug trafficking, managing the consequences of weapons of mass destruction incidents, and the protection of critical infrastructures are possible events looming on the horizon within our own borders.[11] Furthermore, there are many situations where important national interests and humanitarian and other interests will require active intervention throughout the world.[12]

In support of the National Security Strategy, the National Military Strategy of the United States requires the worldwide engagement of forces in peacetime and throughout the spectrum of conflict.[13] The worldwide commitment of U.S. Forces is considerable. On any given day, the Total Force is deployed in support of 10 Joint and Combined Operations and participates in 11 exercises in over 70 countries.[14] As of September 30, 1998 there were 259,871 members of the Army, Air Force, Navy, and Marine Corps located in approximately 138 foreign countries.[15] The type, extent, and scale of various operations are extremely varied. The scope of operations may have a single purpose, such as humanitarian assistance in disaster relief operations, or multiple purposes that may combine such elements as peace enforcement, counter drug, and nation assistance.[16] Further complicating the equation, operations may transition from one state to another at any point along the range of military operations.

What does this mean to the individual soldier? Fulfillment of national security strategy will require the commitment of forces at strategic locations throughout the world.[17] This will place even greater demands on today's soldiers. At the current deployment rate, soldiers entering the military today will experience an average of 14 deployments by the time they serve 21 years or more in the service, meaning a soldier can expect to deploy once every 18 months.[18] This staggering operations tempo is not just limited to deployments. The intensity of garrison activity and workload is frequently greater than that which occurs during military deployments.[19] The career soldier of today must function in an organizational climate best described by the military's definition of operations tempo: deployments, training, or garrison duties.[20]

Active duty are not the only personnel involved in the conduct of military operations. The personnel that comprise the Total Force represent diversity in organizational background and nationality. Under the authority established in title 10, United States Code, section 167, the Services and the U.S. Special Operations Command organize, train, and equip Active and Reserve component forces, military retirees, DOD civilian personnel, contractor personnel, and host-nation personnel.[21] Further complicating the picture are probable requirements to interact and operate with multinational coalitions, various

nongovernmental organizations, foreign governments, and international organizations, with the ultimate goal of achieving unity of effort by consensus.[22]

The strategic implications for health care providers tasked with global support of the Total Force are significant. Today and certainly in the future, the concept of providing comprehensive care only to active duty solders during deployments may be unrealistic, as is the industrial age model of assigning heath care providers based on the number of solders assigned to a given geographic location. A more realistic picture is one of providing comprehensive care to the Total Force, based on actual treatment needs. Requirements may also exist to provide care to members of coalition forces or members of other organizations. The wide disparity in combat health support provided members of a multinational force requires coordination, particularly with specialized medical care.[23] The capabilities necessary to meet these requirements must rely on an information-based strategy.

Long-term periodontal care presents unique challenges in today's global environment. Our traditional customer, the active duty soldier, is often deployed, and when not deployed is faced with numerous challenges from training to garrison duties. Guard and reserve component soldiers are increasingly called to support operations. The dental requirementsto include non-traditional customers, such as retirees recalled to active duty, DOD civilians, contractors, and other players, could significantly complicate the current system. An examination of periodontal disease, current treatment methods, and the current system will clarify the challenges of providing world-class periodontal treatment for a highly mobile population in a constrained fiscal environment.

EPIDEMIOLOGY

Periodontal disease is a chronic inflammatory disorder that requires long-term treatment and care.[24] Periodontal disease is a significant health concern in the United States; and therefore, of concern to members of the United States military. The periodontal diseases can be classified as adult periodontitis, localized juvenile periodontitis, generalized juvenile periodontitis, and rapidly progressive periodontitis. The exact extent of the disease in a military population is not known; however, an examination of the epidemiological literature provides a basis for estimation. A frequent measure of disease used in epidemiological studies is prevalence, which is defined as the proportion of individuals in a group who exhibit the condition at a point in time.[25] The bottom line is that some 5 percent to 20 percent of the population suffer from severe, adult periodontitis, though mild to moderate periodontitis affects a majority of adults.[26] Early onset periodontitis, which comprise localized juvenile periodontitis, generalized juvenile periodontitis, and rapidly progressive periodontitis affect less than 1 percent of the population.[27] However, these cases can be extremely time and resource intensive to treat.

The Army has 361,205 soldiers 17 to 34 years of age.[28] Assuming a 1 percent prevalence, that equates to 3600 cases of early onset periodontitis. This is the disease most likely to affect this age group. In the 35 to 65 year old group the Army has 102,419 soldiers.[29] Estimates predict an upper limit of 20,400 cases of adult periodontitis in that older age group.

CURRENT SYSTEM

The current Army Dental Care system relies on referrals for the identification of periodontal patients. As in a private practice environment, it is incumbent on general dentists to recognize the signs and symptoms of periodontal disease, and then make appropriate referrals for specialty care. Additional assets in the screening process are registered dental hygienists and other ancillary personnel who provide varying levels of hygiene support. Only when these patients are identified can they be given an appointment for periodontal treatment, and entered into the system.

A frequent impediment to periodontal treatment is the amount of time a patient has remaining at a particular duty assignment. Unfortunately, many patients present for annual dental examinations just before transferring to a new duty station. This results in a request for a referral that will not occur because of the lack of time remaining at the duty station. The extremely high operations tempo imposed on our soldiers also delays entry into the system for treatment. From the standpoint of providing treatment, many soldiers are on temporary duty assignments, deployments, or have such a multitude of job requirements that they just realistically cannot and do not present for treatment.

The reserve forces play an extremely important role in military operations. Operations today depend on the reserve components whether the contingency is small scale or a major theater war.[30] Since 54 percent of Army is currently in the Reserve Components, the National Guard and Army Reserve will continually be called upon to support numerous missions throughout the world.[31] As part of its plan to complete the integration of the Active and Reserve components, future rotations to Bosnia-Herzegovina will include Reserve Component units deployed for six to twelve months, with Army National Guard divisions commanding three of the next six Stabilization Force rotations.[32]

As Army Reserve and Army National Guard units and personnel supplement active Army forces world wide, a significant number of these personnel will have periodontal disease, based on its prevalence in their age group. Their needs present an additional set of challenges. Unless called to active duty for an extended deployment, dental treatment is provided in a civilian private practice setting.

The Army Dental Care system can expect new periodontal patients entering the system for treatment in several ways. The most common way is by referral from an Army dentist to a periodontist for diagnosis and treatment. National Guard and Army Reserve soldiers may enter the system, already in different phases of treatment from private practitioners. It is also possible that patients from allied nations may enter the system having had the majority of their dental treatment done by dentists in their nation, whose philosophy of treatment may differ from that of Army periodontists.

THE NEW STANDARD FOR ACCESS TO CARE

While it is difficult to define a rigid medico-legal and ethical standard of care that applies to all situations, it is possible to delineate a patient's right to periodontal care. The American Academy of Periodontology describes the rights and responsibilities of periodontal patients. Three major points have

significant implications for the delivery of periodontal care in a global military environment. Patients have a right to appropriate diagnosis and treatment followed by an appropriate course of treatment.[33] While general dentists will provide the majority of a patient's care, patients have a right to expect a referral to a periodontist if the required treatment is beyond the capability of the general dentists.[34] Patients have a right to expect continuity of care, which may be provided by the general dentist-hygienist team or by the periodontist-hygienist team, as determined to be in the best interest of the patient.[35]

The above guidelines form the basis of an emerging definition of access to periodontal care in the United States. It is incumbent on the Army Dental Care System to ensure patients have access to periodontal care on a global basis. There are a multitude of impediments to access. The ability to obtain periodontal treatment becomes even more difficult when soldiers are stationed at remote locations that lack specialty care. If travel time is significant or requires temporary duty orders, soldiers are often discouraged from seeking care. Under these circumstances, periodontal disease remains untreated, or in cases where treatment has been initiated, proper follow up care does not occur.

Access becomes even more complicated during deployments. In the future the Army will not have the luxury of six-month build-ups and secure rear-area bases that include robust modular dental units.[36] Requirements to keep the logistics footprint to just what is needed, no more and no less, will have implications relative to the number of personnel and the weight and cube of equipment. It is a given that future operations will occur in an uncertain, complex, and extremely dynamic environment. A new paradigm is needed to address the provision of dental service support in a theater of operations. This is particularly true regarding the provision of periodontal treatment.

An even bigger challenge is personnel stationed or deployed in extremely small numbers to remote locations where the size of the deployment or military population does not justify collocating a comprehensive support infrastructure. The current system does not adequately address long term care needs of these personnel. While it is easy to pass the responsibility to someone else, the Army Dental Care System must take an active role in ensuring access to care.

It is tempting to outsource needed periodontal care on a contract or reimbursement basis. Army doctrine supports this concept. Logisticians routinely use available host nation infrastructure and contract for services and supplies.[37] United States Army doctrine is authoritative, but requires judgment in its application, particularly when dealing with periodontal service support. The alternative to outsourcing is to use organic personnel of modular dental treatment teams. Either course of action is feasible, but requires different resources for contracting. The bottom line is that access to periodontal care throughout all phases of treatment is a requirement.

STANDARD OF CARE IN CURRENT TREATMENT

Periodontal treatment usually employs a team approach. The team consists of a periodontist and dental hygienist. A licensed dental auxiliary who is an oral health educator and clinician, the hygienist

uses preventive, educational, and therapeutic methods to control oral disease.[38] General dentists and other dental specialties contribute significantly in providing care for complex cases.

A typical periodontal case requires several phases of treatment and multiple appointments. After a comprehensive evaluation by the periodontist, the patient sees the hygienist. The hygienist provides a thorough cleaning and educates the patient on oral hygiene. A general dentist places any needed restorations. The patient is then reevaluated by the periodontist. The periodontist performs indicated surgical treatment. After healing is complete the patient is placed into an individualized supportive periodontal treatment program. Once periodontal disease is under control the patient sees the prosthodontist for any complex prosthetic treatment.

There are a wide variety of treatment modalities available to the periodontist. Providing the best periodontal treatment today requires the clinician to interpret the vast amount of information published in the refereed periodontal literature. The evidence-based approach to evaluate the periodontal literature provides periodontists with a systematic method for evaluating relevant information regarding diagnosis, treatment and prognosis, resulting in improved periodontal outcomes.[39] Individualized treatment, supported by the current periodontal literature, ensures patients receive treatment consistent with the standard of care.

SUPPORTIVE PERIODONTAL TREATMENT

Post treatment, the observation of chronic periodontal disease occurs during supportive periodontal treatment. Monitoring is crucial because the average patient will go back and forth between active therapy and supportive periodontal treatment.[40] Members of the Army who have successfully completed comprehensive periodontal treatment may find themselves deployed, on temporary duty, or involved in a permanent change of station. The current system makes it extremely difficult or even impossible to present for necessary follow up care. Under those circumstances the tendency is for the disease to get worse, whereas when recommended intervals are followed patients' periodontal status remains stable.[41]

The positive results from complying with recommended follow up intervals include not only an overall increased wellness, but increased fiscal savings for the Army. When follow up care is sporadic or non-existent, periodontal disease worsens, requiring further treatment that is more costly in terms of dollars and time. The worst-case scenario is tooth loss. While this eliminates the need for further periodontal treatment, the time and costs for prosthetic rehabilitation are extensive. The most cost effective course of action is to ensure patients receive needed follow up care.

INFORMATION AND COMMUNICATION BASED SYSTEM

A key component to ensuring the continuity of periodontal care for patients that move throughout a global dental care system is the treatment record. An information age electronic treatment record could

include all entries, charting, laboratory results, and radiographs. This would allow the global transfer of vital treatment information instantaneously.

The extraordinary increase in the power of desktop personal computers provides the capability to process the digital information that makes up a comprehensive database of treatment records. Local area networks and the Internet provide the connectivity that allows the transfer of information. Communications among health care providers is enhanced by the ease of electronic mail. Establishing the horizontal linkages needed to consult on cases goes beyond the traditional military to military consult. Treating the Total Force may require military periodontists to establish a dialogue with a civilian practitioner who provided treatment to a reservist or contractor.

A novel method of leveraging information technology is teledentistry. Teledentistry is the provision of dental care where the patient and provider are not physically collocated.[42] Taken literally, this definition implies a highly specialized technology that in its purest sense allows a form of two-way video conferencing between a patient and a health care provider. Most importantly, the true power of this system, is that it facilitates the transfer of clinical information in real time.

Information age technology provides the tools for the storage and transfer of information. The security of a global computer and communication system would be an extremely high priority. The confidentiality of patient treatment information is key to maintaining the confidence of patients. Encryption and communications security would be an absolute requirement. Even with the technological security methods there are risks.

RISKS OF INFORMATION BASED TECHNOLOGY

One danger of relying on technology-based systems is the possibility of asymmetric threats directed against vital systems. The vulnerability of an organization to information warfare increases as its dependence on technology increases.[43] As our dependence on advanced computer and communications systems increases, it invites cyber warfare attacks to an opponent that sees no strategic benefit in a direct confrontation with the Unites States in a regional war.[44] What makes this type of warfare extremely difficult to defend against is that traditional physical security methods, while still relevant in protecting against conventional threats, are of minimal importance. The attacker can have unlimited range and pose a threat from far beyond usual security boundaries.[45]

An information-based threat has profound implications. Cyber weapons with the capability to disrupt or disable information technology and national strategic infrastructure are possible.[46] Medical databases and communications systems could be disrupted in an attack.

It could be argued that a prudent course of action would be to resist implementation of a technology based strategy, concentrating instead on manual systems that would be impervious to many of the cyber threats. However, failure to adequately exploit technology is an even more dangerous course of action. The provision of responsive combat service support, today and certainly in the future, demands successful exploitation of all currently available and future information technologies. Regardless of

possible threats, combat service support elements must embrace state of the art information technologies.

THE IMPERATIVE FOR CHANGE

The power of new technologies to impact on the future of the United States Army cannot be overstated. With the power and immense potential of software as the starting point, military technology is on the threshold of a leap foreword comparable with, if not greater than, revolutions that brought about the mechanization of land forces and development of airpower.[47] To stay competitive, it is incumbent on all organizations to embrace the future. There will be many challenges in overcoming resistance to new ways of doing business.

The road to the future is sometimes best understood by examining the past. The following insight taken from history illustrates an important idea. "The most compelling lesson from the 1920s and 1930s is that some militaries were much better than others at developing and implementing successful concepts and also making the organizational changes to fully exploit new technologies. Innovation is not necessarily or primarily a function of budget. Many of the interwar innovations came at a time of low budgets and small forces."[48] This statement is particularly true in today's environment where decreasing budgets, smaller staffs, and the end of the cold war would seem to imply maintaining the status quo.

The challenge is to not let complacency with old ways of doing business permeate an organization. The proliferation of technology may no longer afford the luxury of observing developments from the sidelines.[49] Organizations that sit back today will be obsolete tomorrow. The implementation of a technology strategy must allow for incorporating future advances. In today's rapidly changing world, defining an exact and ridged set of standards may be counterproductive. Such standards would likely delay the implementation of technology systems to the point of making them obsolete by the time they are fielded. What is important is to define requirements in terms of capabilities.

The current business practice of not having a technology-based, integrated global system for periodontal care is obsolete. Today's soldiers are extremely sophisticated. They understand and expect world-class customer service. If our soldier's expectations are not met, the survival of Army dentistry is at risk. The alternative is to outsource all dental treatment to a civilian contractor.

RECOMMENDATIONS

The most important business practice change is the creation of a database listing periodontal patients. In the absence of a completely automated dental record the minimum information required would list the type and dates of treatment and follow up care. This could easily be accomplished using off the shelf software. When a suitable electronic dental record is adopted it must include the Army Reserve and Army Guard. An even bolder implementation would also include the Air Force and Navy. The ultimate

goal should be the seamless transfer of periodontal treatment information worldwide regardless of service or whether a patient is active or reserve.

The Army Dental Corps must establish email addresses for each periodontal department worldwide. This would ensure a consistent address for contacting the assigned periodontist at a given location. This address would remain unchanged and readily available to every member of the dental health care system. This system assumes that every periodontal clinic has an up-to-date personal computer and ready access to the Internet.

A simple electronic periodontal transfer record would be completed on each soldier as a part of out-processing. The information could be as simple as describing what phase of treatment the soldier has completed and what future treatment is anticipated. This would greatly simplify entry into the treatment system at a new location for soldiers.

Treatment information could be forwarded to a soldier's new assigned duty station when he or she signed out their dental record from the losing facility. The gaining unit could anticipate the arrival of soldiers needing periodontal treatment and plan accordingly. A simple copy and paste of a soldier's information into the gaining facilities database would allow pre-inprocessing. The soldier's arrival would be confirmed by relating the clinic's information to SIDPERS data.

Tele-dentistry is not a substitute for having a periodontist present to treat patients. However, it does offer a realistic mechanism for periodontists to provide consultations and treatment advice to general dentists at locations where specialists are not located. This could also be used to determine valid requirements prior to expensive evacuations from remote locations. Overall tele-dentistry has the potential to facilitate access to care while reducing costs to the Army.

Meeting the expectations of our patients regarding access to periodontal care is a responsibility of the Army Dental Care System. The results will be significant. Having the right treatment team for the right patients can become a reality. Cost will be reduced due to utilization of the concept of just in time logistics. The periodontal literature supports the concept that patients who are appropriately treated and receive needed follow up care will have fewer dental emergencies. This will reduce future cost to the military and result in fewer disruptions to training.

The strategy required to meet the needs of our customers must fully leverage information age technology, in terms of computers and communications, which exists today and in the future. The worldwide apportionment of periodontal treatment teams must be based on accurate treatment needs, not on epidemiological estimates. This can only be accomplished if the periodontal needs of our treatment population are documented in an appropriate electronic periodontal record, as part of a global database. Security of patient treatment data is paramount, as all patients have a right to expect privacy. The implementation of a global system must be cognizant of the potential asymmetric threats that potentially could be directed against medical information and communication systems; however, such threats should be viewed as challenges not as impediments to implementation. The overall most important benefit is an increased wellness of our soldiers.

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